

# Quality of Hospital Bed Performance Studies based on Pabon Lasso Model

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## Abstract

Hospitals' bed productivity has a remarkable effect on health system performance. The Pabon Lasso Model (PLM) is a useful tool for evaluation of inpatient beds performance and there is a growing trend in use of this technique in hospital performance evaluation. The aim of this study is to review the literature on PLM to gain insight into quality the results of these studies. By adopting a systematic review style, the full text of a total of 29 documents on the topic was reviewed. While in 81.3% (n=26) of the documents Pabon Lasso diagram has been represented complete and correctly, the results of a large fraction of the reviewed studies (59.6%) was limited to identifying the status of the hospitals in question the Pabon Lasso chart, without further analysis of the chart in the context of hospital resources. Our study hence recommends that future studies can draw further useful implications from the PLM model by focusing more on the interpretation of the results in the practical context of hospital management.

**Keywords:** Hospital management, Hospital bed performance, Pabon Lasso Model

## Background and Objectives

Hospitals are responsible for direct delivery of health-care services to community. In some countries, these organizations consume more than 50% of total health expenditure. Therefore, hospital performance and productivity will have significant effect on the performance of the health system [1-3].

Optimization of hospital performance requires constant monitoring of the way hospital resources are utilized [4, 5, 6]. Several methods have been developed to evaluate hospital performance, including data envelopment analysis (DEA), stochastic frontier analysis (SFA), and Pabon Lasso Model (PLM) [7-11]. The first two methods use sophisticated mathematical formulations, which make their use difficult for many hospital managers. Alternatively, PLM offers a simple graphi-

cal tool for rapid analysis of hospital performance that makes it easy to use for most hospital administrators. Introduced in 1984, PLM enables identifying both current status of the hospital in terms of utilizing its resources and the trend of hospital performance during time. According to PLM, the plane of the relative strength of BOR and BTR can be divided into four zones; Low-Low (Zone 1); High-Low (Zone 2); High-High (Zone 3), and Low-High (Zone 4) (Figure 1). By mapping the measured key hospital performance indicators, including bed occupancy rate (BOR), bed turnover rate (BTR), and average length of stay (ALS) onto the chart, the PLM enables qualitative evaluation of current performance of hospital [9-12], and identification of future strategies to improve it.

Given the growing trend of PLM use in monitoring hospital performance, the present work aimed to explore general features, quality, and findings of these studies.

## Methods

This review study was conducted according to PRISMA guidelines [13]. Literature resources including Google

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**Table 1 Pabon Lasso Chart**

Bed occupancy rate	
Bed turnover rate	Zone II (high BTR, low BOR) <ul style="list-style-type: none"> <li>• Excess bed capacity</li> <li>• Unnecessary hospitalization</li> <li>• Many patients admitted for observation</li> <li>• Predominance of normal deliveries</li> </ul>
	Zone III (high BTR, high BOR) <ul style="list-style-type: none"> <li>• Good quantitative performance</li> <li>• Small proportion of unused beds</li> </ul>
	Zone I (low BTR, low BOR) <ul style="list-style-type: none"> <li>• Excess bed supply</li> <li>• Less need for hospitalization</li> <li>• Low demand/ utilization</li> </ul>
	Zone IV (low BTR, high BOR) <ul style="list-style-type: none"> <li>• Large proportion of severe vases</li> <li>• Predominance of chronic cases</li> <li>• Unnecessarily long stays</li> </ul>

Scholar, Pubmed, Scopus, Magiran, and SID were explored. The obtained documents and the cited references were examined to identify further relevant references. Inclusion criteria were: 1) the unit of analysis being the hospital; 2) hospital performance being evaluated by PLM. Search terms that were used, singly and in combination, included “hospital performance”, “bed utilization”, “Pabon Lasso model”, “bed turnover”, “length of stay” and “bed occupancy”.

The initial search yielded 120 documents. Titles and abstract of the documents were reviewed separately. By excluding duplicates and non-relevant studies 26 documents were left for full text analysis. Supplementary search conducted based on initial literature references, found three additional articles. In sum 29 references were reviewed.

## Review

Table 2 summarizes the details of the documents reviewed in the present study. As seen, the total number of hospitals surveyed in each study ranges from one to 751 hospitals.

Table 3 present the results of content analysis of the reviewed documents. In 62.5 % (n = 20) of the studies the hospital type in terms of being teaching or non-teaching has been distinguished. In addition, 56.3 % (n=18) of documents had distinguished general and specialized hospitals. Only 38.7% of the documents have provided information on the size of hospital(s) they have investigated.

While in 81.3% (n=26) of the documents Pabon Lasso diagram has been represented complete and correctly, in 9.4% (n=3), problems were identified in the charting.

The results of a large fraction of the reviewed studies (59.6%) was limited to identifying the status of the hospitals in question the Pabon Lasso chart, without further analysis of the chart in the context of hospital resources (Table 3).

Each performance evaluation method has its own advantages and limitations. Pabon Lasso model provides simplicity to evaluation of hospital performance, which helps hospital managers to quickly grasp the status of their healthcare centers in comparison with other hospitals. This renders use of the PLM in hospital performance analysis more practical compared with several other sophisticated tools [4, 10]. Nevertheless, some restrictions of this model, including limited number of indicators, have been highlighted in the literature [25]. The model has also been considered to be limited in scope due to taking into account only inpatient bed performance [13, 23, 25].

## Conclusions

The aim of the present study was to evaluate the quality of the studies that have investigated the performance of healthcare settings using PLM. While the majority of the studies have correctly set up the chart, less than half of them have drawn specific recommendations for hospital performance improvement to be applied in the hospitals in question. Although being simple, the PLM allows in-depth analysis of the hospital performance and can guide strategies to improve it [11]. Our study therefore recommends future studies to focus more on the interpretation of PLM results in terms of various aspects of hospital management and

**Table 2** Details of reviewed studies

First author	Publication date	Language	No. of hospitals surveyed	Study population
Younsi (14)	2014	English	40	Public and private hospitals in Tunisia
Barfar <i>et al</i> (15)	2014	English	11	Hospitals affiliated with Zahedan UMS- Iran
Mehrtak <i>et al</i> (16)	2014	English	18	general hospitals located in Eastern Azerbaijan Province- Iran
Kalhor <i>et al</i> (17)	2014	English	6	Hospitals affiliated with Qazvin UMS- Iran
Mirekey <i>et al</i> (18)	2014	Persian	12	Hospitals affiliated with Kordistan UMS- Iran
Karami matin <i>et al</i> (19)	2014	Persian	8	Educational hospitals of Kermanshah UMS- Iran
Mohammadi <i>et al</i> (20)	2014	English	16	hospitals in Kermanshah province- Iran
Lotfi <i>et al</i> (21)	2014	English	16	Teaching and non-teaching hospitals of Ahvaz city- Iran
Movahednia <i>et al</i> (2)	2014	Persian	8	Educational hospitals of TUMS-Iran
Gholipour <i>et al</i> (22)	2013	English	2	Tabriz obstetrics and gynaecology teaching hospitals- Iran
Mehrolhasani <i>et al</i> (23)	2013	Persian	23	Hospitals of Kerman province- Iran
Ajlouni <i>et al</i> (24)	2013	English	15	General hospitals of Jordan
Arzamani <i>et al</i> (6)	2012	Persian	6	Educational hospitals of Khorasan UMS- Iran
Asbu <i>et al</i> (25)	2012	English	40	Local hospitals of Malawi
Bastani <i>et al</i> (26)	2012	English	23	Educational hospitals of Shahid Beheshti UMS- Iran
Ebrahimpour <i>et al</i> (27)	2012	Persian	10	Educational hospitals of Mashhad UMS- Iran
Motaghi <i>et al</i> (28)	2012	English	6	Educational hospitals of Kashan UMS- Iran
Nekooei Moghadam <i>et al</i> (29)	2012	Persian	8	Educational hospitals of Shiraz and Kerman UMS- Iran
Kavoosi <i>et al</i> (30)	2012	Persian	14	Educational hospitals of Lorestan UMS- Iran
Zahiri <i>et al</i> (3)	2012	Persian	26	Hospitals of Jondishapoor UMS- Iran
Bahadori <i>et al</i> (4)	2011	English	23	Educational hospitals of Orumie UMS- Iran
Hadi <i>et al</i> (31)	2011	Persian	31	Educational hospitals of Esfahan UMS- Iran
Goshtasbi <i>et al</i> (10)	2009	English	1	Educational hospitals of Kohgiluyeh UMS- Iran
Govender (32)	2004	English	15	Local hospitals of kwa-Zulu
Montazeri <i>et al</i> (12)	2004	Persian	1	Educational hospital of TUMS- Iran
Somanathan <i>et al</i> (33)	2000	English	159	Health center of Serilanka
Nazari (34)	1998	Persian	15	Not stated- Iran
Toorani (35)	1997	Persian	5	Educational hospitals of TUMS- Iran
Taleb shahrestani (36)	1997	Persian	751	All hospitals of Iran

to use the advantages of the model to draw practical implications for hospital performance optimization.

#### Abbreviations

(BTO): bed turnover; (LOS): length of stay; (BOR): bed occupancy rate

#### Competing Interests

The authors declare no competing interests.

#### Authors' Contributions

AA and FF jointly designed the study. FM and MR contributed

to data collection and analysis. HZ, AA, and FF contributed to drafting the manuscript. All authors read and approved the final manuscript.

#### Acknowledgements

This article is based on "Systematic review of hospital inpatient beds performance assessment models" research project. This project was planned and implemented by Institute for Health Sciences Research (IHSR) and was supported by Iranian Academic Center for Education, Cultural and Research (ACECR). The authors would like to thank everybody that contributes in this study.

This project was supported financially by Iranian Academic Center for Education, Cultural and research (ACECR).

**Table 3** Quality assessment of Pabon-Lasso-Model-based studies

Document ID	Teaching/non-teaching hospitals distinguished	General/specialized Hospitals distinguished	Beds number mentioned	Wards mentioned	Correct charting	Statement of guidelines to promotion
1	Yes	Yes	No	No	Yes	Yes
2	Yes	Yes	Yes	No	Yes	Yes
3	No	Yes	Yes	No	Yes	Yes
4	Yes	Yes	Yes	No	Yes	Yes
5	No	No	No	No	Yes	No
6	Yes	No	No	No	Yes	Yes
7	No	No	No	No	Yes	No
8	No	No	No	No	Yes	No
9	Yes	Yes	Yes	No	Yes	Yes
10	Yes	Yes	No	Yes	Yes	No
11	No	No	No	No	Yes	No
12	Yes	No	No	No	No	No
13	No	Yes	No	Yes	No	No
14	Yes	No	No	No	Yes	Yes
15	Yes	No	No	No	Yes	No
16	Yes	Yes	No	No	Yes	No
17	Yes	No	No	No	Yes	No
18	Yes	No	No	No	Yes	No
19	No	No	No	No	Yes	Yes
20	No	No	Yes	No	Yes	No
21	Yes	Yes	Yes	No	Yes	No
22	Yes	Yes	No	No	Yes	Yes
23	Yes	Yes	Yes	No	Yes	Yes
24	Yes	No	No	No	Yes	No
25	Yes	Yes	Yes	Yes	Yes	Yes
26	No	Yes	Yes	Yes	Yes	Yes
27	No	No	No	No	Yes	No
28	Yes	Yes	No	No	No	No
29	Yes	Yes	No	No	Yes	No

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**Please cite this article as:**

Afsoon Aeenparast, Faranak Farzad, Farzaneh Maftoon, Hamed Zandian, Mehdi Rezaei Yazdeli. Quality of Hospital Bed Performance Studies based on Pabon Lasso Model. *International Journal of Hospital Research* 2015, 4(3):143-148.